Sound Velocity and Attenuation Near the Polymerization Transition in Sulfur

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Polymerization transition in liquid sulfur near 430 K is a well known example of equilibrium polymerization. In the last decades essential progress has been made in experimental investigation of this transition and in its theoretical interpretation. However, there is still no well established theory describing all aspects of this phenomenon. Additional experimental information is desirable to provide a complete picture and to develop a comprehensive theory of equilibrium polymerization. First results of a new acoustical investigation of the polymerization transition in liquid.

Sulfur will be reported. Sound velocity and attenuation have been measured near the polymerization transition (from the melting temperature at about 390 K up to 470 K and back to supercooled state down to 350 K) under saturation pressure at frequency 7.2 MHz. Sulfur of original purity 0.999999 was sublimated under vacuum in a quartz acoustical cell which was then hermetically sealed. Diameter of a sample space was 12 mm and the length (acoustical pass) was 2.9 mm. The cell was held in an oil bath, which temperature was measured by a standard cooper-constantan thermocouple attached to the cell near the sample space. A precision pulsed phase-sensitive technique has been employed. Uncertainty in relative measurements of sound velocity and attenuation was 0.05% and 20%, respectively. A distinct specific feature, namely a sharp change in a temperature derivative of sound velocity, was found at the polymerization transition. Contrarily, no specific feature was found in sound attenuation. A possible interpretation of the obtained results and necessary further experiments will be discussed. The work was partly supported by a research grant of the University of Utah.